Myocardial Infarction with Non-Obstructive Coronary Arteries (MINOCA)

John Beltrame

University of Adelaide
Central Adelaide Local Health Network
Adelaide, Australia
Angiographic Findings in Acute MI

Pioneering DeWood Studies
- Early angiography in MI patients

- STEMI: ‘open artery hypothesis’
  thrombolytic therapy
  primary PCI

- NSTEMI: atherothrombosis
  early anti-thrombotic
  revascularisation

- MINOCA: insignificant atheroma
  natural history?
  role of therapy?

The What, When, Who, Why, How and Where of Myocardial Infarction With Non-Obstructive Coronary Arteries (MINOCA)

Sivabaskari Pasupathy, BSc; Rosanna Tavella, BSc, PhD; John F. Beltrame, BSc, MD, PhD

- **What** is MINOCA?
- **When** to Diagnose MINOCA?
- **Who** is at Risk of MINOCA?
- **Why** diagnose MINOCA?
- **How** to Manage MINOCA?
- **Where** to next for MINOCA?

What is MINOCA?
Myocardial Infarction with Non-Obstructive Coronary Arteries

• **Acute Myocardial Infarction Criteria**
  - **Cardiac biomarker** - rise ( > 99\text{th} \text{ percentile}) and/or fall
  - **Clinical marker** – one of the following
    - ischaemic symptoms
    - new ST/T changes or new LBBB
    - development of pathological Q waves
    - new loss of viable myocardium or RWMA on imaging

• **Non-Obstructive Coronaries**
  - **Angiography**: Normal (<30%) or mild CAD (≥ 30% but < 50%)

• **No Clinically Overt Cause for ACS Presentation**

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Agewall (2016) Eur Heart J
When to Diagnose MINOCA?

- ACS Presentation
- After Angiography - No Obstructive CAD
- No Overt Cause
  - Avoid if classical myopericarditis presentation
Clinical Presentation
55-year old female presented with sudden onset of central chest pain for 2 hours.

Troponin T [Reference Range <29ng/L]
Initial: 99 ng/L
6 Hours: 301 ng/L

ECG
ST elevation in V3-V5

Coronary Angiography
No significant coronary stenosis

D-Dimer: Negative
Left Ventriculogram: Normal

1. Acute Myocardial Infarction
2. Non-Obstructive Coronary Arteries
3. No apparent cause for presentation

MINOCA - 'a working diagnosis'
Myocardial Infarction with Non-Obstructive Coronary Arteries
Who is at Risk of MINOCA?

• Systematic Review to establish:
  ➢ Prevalence
  ➢ Cardiovascular Risk Factors
  ➢ ECG Changes
MINOCA Review - Search Strategy

PubMed and Embase Database Searches (1966-2013)
‘Myocardial infarct’, ‘angiogram’, ‘non-obstructive’(1,897 publications)

Original Infarct angiography Studies (1,033 publications)

MINOCA Studies with Original Data (152 publications)

Study cohort > 100 patients (88 publications)

Consecutive Studies (42 publications)

MINOCA Systematic Review Clinical Studies
• Prevalence – 28 publications (177,432 AMI patients)
• Risk Factors – 15 publications (81,587 AMI patients)
• Prognosis – 8 publications (9,564 AMI patients)

MINOCA Prevalence

- Pooled 28 publications
  - AMI + angio findings
  - consecutive recruit
  - at least 100 patients
  - 177,432 AMI patients

- Overall Prevalence
  7.0% (95% CI: 6%, 8%)

MINOCA Comparative CV Risk Factors

- **Women**: 24% MINOCA, 43% MI-CAD
- **Hyperlipidaemia**: 21% MINOCA, 32% MI-CAD
- **Hypertension**: 45% MINOCA, 52% MI-CAD
- **Smoking**: 42% MINOCA, 39% MI-CAD
- **Diabetes**: 15% MINOCA, 22% MI-CAD
- **Family Hx CAD**: 21% MINOCA, 27% MI-CAD

MINOCA Acute STEMI Presentation

• 10 studies 
  (1,998 patients)

• STEMI 33% 
  (95% CI: 22%, 44%)

Proportion (95% CI) % Weight

- Rossini, 2013 (29)
  0.21 (0.17, 0.27)  11.56

- Sun, 2012 (31)
  1.00 (0.29, 1.00)  5.51

- Kang, 2011 (38)
  0.36 (0.31, 0.41)  11.57

- Uchida, 2010 (39)
  0.15 (0.02, 0.45)  8.25

- Frycz-Kurek, 2010 (40)
  0.38 (0.35, 0.41)  11.73

- Ong, 2008 (43)
  0.07 (0.01, 0.22)  10.72

- Strunk, 2006 (47)
  0.53 (0.35, 0.71)  9.10

- Germing, 2005 (50)
  0.22 (0.10, 0.39)  9.91

- Hochman, 1999 (52)
  0.64 (0.58, 0.69)  11.46

- Sharifi, 1995 (54)
  0.00 (0.00, 0.27)  10.19

Overall
  (I-squared = 95.4%, p=0.000)

  0.33 (0.22, 0.44)  100.00

Why Diagnose MINOCA?

• Clinical Recognition
  ➢ ‘False positive STEMI Diagnosis’

• Evaluation of Underlying Cause
  ➢ Non-cardiac: Pulmonary Embolism
  ➢ Cardiac: Myocardial – Myocarditis, CM
    Coronary – SCAD, Spasm, Emboli
    Thrombotic – Factor V Leiden

• Guarded Prognosis

MINOCA Prognosis

MINOCA Comparative Prognosis

Korean AMI Registry
• 8,510 consecutive AMI
  ➢ Gp I – MINOCA (n=372)
  ➢ Gp II – 1 or 2 VD (n=6,136)
  ➢ Gp III – LMCA/3VD (n=2,002)

• All-cause mortality at 12 months
  ➢ Gp I  3.1%
  ➢ Gp II  3.2%
  ➢ Gp III 6.5%

Kang et al (2011)
How to Manage MINOCA?

- **Further Assessment:**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Consider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical</td>
<td>Cocaine</td>
</tr>
<tr>
<td>Angiographic</td>
<td>SCAD, Spasm, Slow Flow, emboli, LV</td>
</tr>
<tr>
<td>Pulmonary Emboli</td>
<td>D-dimer, CTPA</td>
</tr>
<tr>
<td>Imaging</td>
<td>CMRI</td>
</tr>
<tr>
<td>Other</td>
<td>Thrombophilia (14%), Spasm (28%)</td>
</tr>
</tbody>
</table>

- **Current Therapies**
MINOCA CMR Imaging Studies

- Myocarditis: 33%
- Ischaemic MI: 24%
- Tako-tsubo CM: 18%
- Hypertrophic CM: 3%
- Dilated CM: 2%
- Other: 7%
- No Abnormality: 26%

MINOCA: Current Management Practice

Pooled data from 4 AMI registries

Aspirin
- MI-CAD (n=39,703): 80%
- MINOCA (n=3,544): 76%

Clopidogrel
- MI-CAD (n=39,703): 56%
- MINOCA (n=3,544): 26%

Statin
- MI-CAD (n=39,703): 55%
- MINOCA (n=3,544): 39%

Beta-blocker
- MI-CAD (n=39,703): 75%
- MINOCA (n=3,544): 61%

CCB
- MI-CAD (n=39,703): 9%
- MINOCA (n=3,544): 23%

ACE-Inhibitor
- MI-CAD (n=39,703): 44%
- MINOCA (n=3,544): 39%

Where to Next for MINOCA?

- Prognosis
- Optimal Assessment Pathway
- Aetiology Targeted Therapies

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ESC working group position paper on myocardial infarction with non-obstructive coronary arteries

Stefan Agewall1*, John F. Beltrame2, Harmony R. Reynolds3, Alexander Niessner4, Giuseppe Rosano5,6, Alida L. P. Caforio7, Raffaele De Caterina8, Marco Zimarino8, Marco Roffi9, Keld Kjeldsen10, Dan Atar1, Juan C. Kaski6, Udo Sechtem11, and Per Tornvall12, on behalf of the WG on Cardiovascular Pharmacotherapy

1Oslo University Hospital Ulevåll and Institute of Clinical Sciences, University of Oslo, Oslo, Norway; 2The Queen Elizabeth Hospital Discipline of Medicine, University of Adelaide, Central Adelaide Local Health Network, Adelaide, Australia; 3Cardiovascular Clinical Research Center, Leon H. Charney Division of Cardiology, Department of Medicine, NYU School of Medicine, New York, NY, USA; 4Department of Internal Medicine II, Division of Cardiology, Medical University of Vienna, Wien, Austria; 5Centre for Clinical and Basic Research, Department of Medical Sciences, IRCCS San Raffaele Pisana, Rome, Italy; 6Cardiovascular and Cell Sciences Research Institute, St George's University of London, London, UK; 7Division of Cardiology, Department of Cardiological Thoracic and Vascular Sciences Padua University Medical School, Policlinico Universitario, Via N Giustiniani, 2, 35128 Padova, Italy; 8Institute of Cardiology, G. d'Annunzio University, Chieti, Italy; 9Division of Cardiology, University Hospital, 1211 Geneva 14, Switzerland; 10Copenhagen University Hospitals (Rigshospitalet and Holbaek Hospital), Copenhagen and Holbaek, and The Faculty of Medicine, Aalborg University, Aalborg, Denmark; 11Abteilung für Kardiologie, Robert-Bosch Krankenhaus Stuttgart, Auerbachstr. 110, 70376 Stuttgart, Germany; and 12Department of Clinical Science and Education Södersjukhuset, Karolinska Institutet, Stockholm, Sweden

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